The purpose of these exercises is to explore antiderivatives with Derive.

Antiderivatives in Derive:
To antidifferentiate a highlighted expression, choose "Integrate" from the Calculus menu. In the "Integrate" dialog box (see Figure 1), choose the variable of antidifferentiation from the drop-down menu and make sure the integral type is "Indefinite." If you know the specific value of the constant of integration, you can type it in the "Constant" field. You'll almost never know this value ahead of time, though, so you should leave this value as 0. Then click "OK," followed by a "Basic" simplification from the Simplify menu.

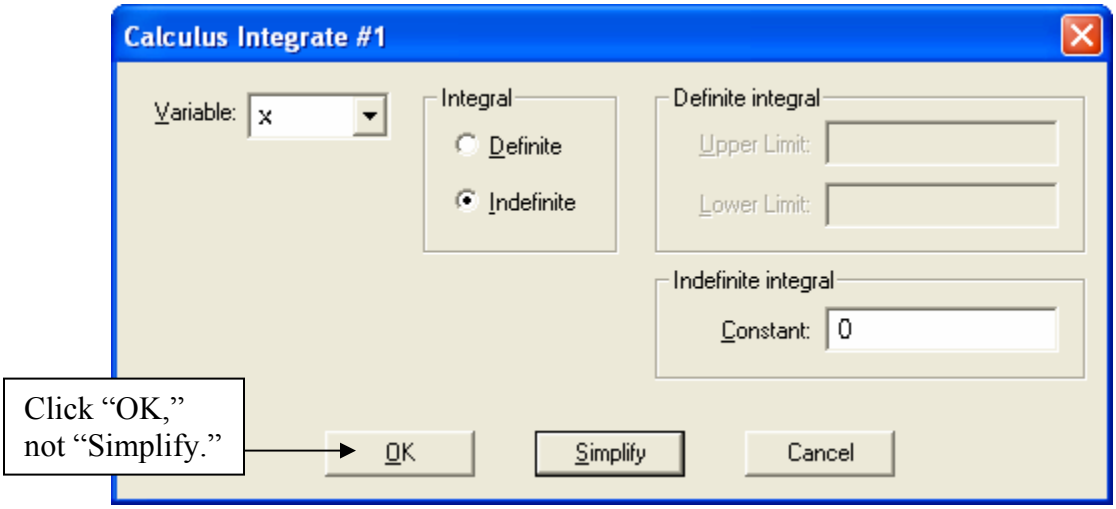

Figure 1: "Integrate" Dialog Box

Try This:
Author the expression $x\sqrt{3x^2+4}$. Then antidifferentiate it as above. After you click "OK," you should see the result $\int x\sqrt{(3x^2+4x)}\,dx$. Verify that this is correct, and then simplify to get the result final result $\dfrac{(3x^2+4x)^{3/2}}{9}$. You can check that this is a correct antiderivative by differentiating.

Copying Results from Derive onto Your Homework Paper:
Recall that when you compute an indefinite integral, you're finding the most general antiderivative for the function involved. So your answer should include an arbitrary constant. When Derive returns $\dfrac{(3x^2+4x)^{3/2}}{9}$ as a result, you should write $\dfrac{(3x^2+4x)^{3/2}}{9}+C$ on your

paper. Also, when Derive antidiffenentiates $\frac{1}{x}$, the result is $\ln x$. You'll need to include the absolute value symbol when you copy this onto your paper: $\ln|x|+C$.

Substituting Values into Expressions:
Sometimes you're given information that allows you to solve for a particular value of the constant *C*, and this involves substituting values into the antiderivative. Perform this substitution by highlighting the expression, and choosing "Variable Substitution" from the Simplify menu. Highlight the variable you'll be replacing, and type the replacement value in the "New Value" field. Then click "OK," followed by a "Basic" simplification from the Simplify menu.

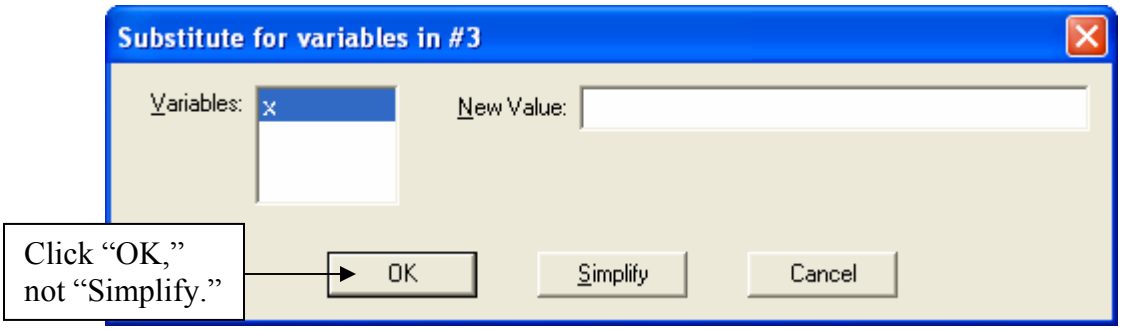

Figure 2: Substitute Dialog Box

Try This:

Highlight the expression $\frac{\left(3x^2+4x\right)^{3/2}}{9}$. Substitute 3 for the *x*-values as described above. After you click "OK," you should see the result $\frac{\left(3\cdot 3^2+4\right)^{3/2}}{9}$. Verify that this is correct, and then simplify to get $\frac{31\sqrt{31}}{9}$.

Exercises:
Use *Derive*^{TM} *6* for the following exercises. Use standard mathematical notation to record the results ***on a separate sheet of notebook paper.*** Do not turn in a print-out of your Derive session.

1. Evaluate each of the following. Verify the results by differentiation. (You may have to do some algebra in order to show that the derivative computed by Derive is indeed equal to the function that you antidifferentiated.)

(a) $\int \ln(3x+5)\,dx$ (b) $\int \frac{3x^2+4x}{x^2-3x+2}\,dx$

2. An object is moving horizontally along the *x*-axis. It started at $x=-5$ feet, and after *t* seconds, its velocity is $v(t)=3te^{-t^2+1}$ feet/second. Find the object's position function.

3. At midnight on the day of the drawing for a big lottery jackpot, 1,452,387 lottery tickets had been sold. At *t* hours after midnight, tickets were sold at the rate of approximately $R(t)=180x+800+126x^2\ln(x+1)-567e^{-x/2}$ tickets per hour.

(a) Find a function $L(t)$ that approximates the total number of lottery tickets that had been sold by *t* hours after midnight.

(b) The lottery drawing was held at 6:00 p.m. What was the total number of tickets that were sold?

(c) How many tickets were sold on the day of the lottery drawing?